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THE OXIDE PURIFIER

THE mood of hopeful anticipation in which we left this subject after the presentation and discussion of the 1948 interim report of the Purification Panel has been fully justified by the results recorded in GRB52 presented to the Institution this year. We are not yet in full possession of the cure, but we now know vastly more of the cause of oxide hardening, and that with a very near approach to certainty. Laboratory experiments have demonstrated, with an elegance on which Drs. Dent and Moignard and the Gas Research organisation generally are to be warmly congratulated, that, provided tar, light oils, and other extraneous bodies are absent, hardening takes place in two stages. There is first the migration of iron oxide and sulphide, in the presence of moisture, towards the points of contact between particles, and then the formation of a dense skin of iron sulphide consolidated with sulphur enclosing a continuous cellular structure. Further consolidation of the skin proceeds by additional deposition as the sulphur deposited earlier re-crystallises. The migration is a welcome feature because it increases the activity of the oxide. The formation of the dense skin is to be prevented or delayed by all possible means.

Avery had shown that 'when iron oxide is alternately sulphided and revivified, its structure can be completely disrupted in such a manner that the sulphur accumulates inside the particles, the iron migrating outwards so as to remain on the surface.' It is on a close study of this behaviour that the explanation of the 'fundamental mechanism of caking' is now based. Demonstrated stage by stage in the laboratories the theory is confirmed by evidence collected from full scale practice. It may therefore be accepted that the *cause* of hardening has been fully discovered.

There remains the *cure*. And this is more complicated still. The problem appears to be how to maintain the migration while preventing the formation of the hard skin, which itself appears to follow the cessation of migration. How far have we got towards a complete code of rules for operation on the works? Last year we had reached a point of certainty that gas cooling and condenser plant should be so arranged, with the inclusion of the electro-detarrer at the correct point, or possibly two points, in the circuit, as to ensure the complete removal of tar fog from the gas stream. This year it is suggested by some that oil washing before the purifiers to remove light oils may also be desirable. Three rules are now more or less tentatively laid down as essential to the minimisation of oxide hardening—use an oxide giving a charge of low density with a minimum of fine particles, maintain a film of moisture on the surface of the oxide at least throughout the greater part of its time in the box, eliminate tar fog and light oil fog. We take it that the next step is to try these rules out in several full-scale works trials, coupled with an investigation of the practice of second box air admission which was mentioned in several cases last year and has been brought up again this year.

The President of
The Institution of Gas Engineers
Mr. C. H. Chester *and* Mrs. Chester
send to all members of the Institution and to other friends in and connected with the Gas Industry their Cordial Greetings and Best Wishes for Christmas and the New Year

Evidence in the report of intensive activity in this most useful and practical research over a large number of works and with the collaboration of a great team of technicians and engineers is most encouraging. And it was not surprising to note that Bournemouth is one of the most enthusiastic and whole-hearted members of the team. To the survey of last year seven more works are added to the list of those where observations and tests are being made.

We have some confidence that the development and trial of Mr. Hopton's 'synthetic oxide' is not being entirely overlooked.

VALUE OF SPENT OXIDE

THE economics of oxide purification obviously depend largely on the value of the spent oxide as a source of sulphur. As we understand it the suggestion is that in the present economic situation the gas industry itself might profitably undertake the extraction of pure sulphur rather than rely on the sale of spent oxide. Extraction by means of the solvent CS_2 is well-known and though the report is properly careful to point out the risks entailed in its use, Mr. Avery assured the meeting that operators under his control using this solvent generally died of old age. At the same time the use of benzene and toluene has certain attractions. The conditions of financial success are stated to be, first, a favourable situation of the extraction plants (this should not be difficult with full co-operation ensured under the area boards), second, that the residue (the 'cleaned' oxide) should be sufficiently active to be re-cycled, say, three times through the boxes and, third, that the sulphur extracted should require little or no further purification from tar. It was possible that the third condition might not be fully necessary at present prices, but it was obvious from the rest of the report that it was both practicable and desirable. The indications are that the second condition can also be readily met. It was indeed the high activity of the residue of sulphur extraction which provided the evidence of iron migration in full-scale operation. And there is the promise that the re-use of these active residues may lead to increased gas throughout, improved performance and, ultimately, reduced capital and labour cost in the whole process of oxide purification.

It may be concluded, then, that so far this well-tried gasworks operations the removal of hydrogen sulphide by the method of dry purification with iron oxide, is holding its own and perhaps even entering on a new lease of life. But it is very satisfactory that our gas researchers are not leaving it at that. The existing process has been essentially an intermittent one. It would be a great advance if it were possible to pass the oxide in some finely powdered form in counterflow with the gas, turning out a clean gas at one end and a high sulphur-content oxide at the other. For this reason the collaboration of Mr. Williamson, of Australia, with our own Dr. Garside in the study of an application of the fluidised solids technique to this problem is of very great interest.

The main objection to the several systems of liquid purification which have been offered to the gas industry is that they have so far failed to remove the last traces of H_2S from the gas but even more that they have involved difficulties in the revivification of the purifying medium and the recovery of sulphur from it. But they did hold out promises of continuous operation and economies in space occupied, and in labour cost, that gave them much appead. It would be an advance indeed if the advantages of a liquid system could be superimposed upon the proved effectiveness of the oxide process. So far the work is of an exploratory nature, on the laboratory scale and with hydrogen sulphide carried in nitrogen. Presumably there will be repetition with the usual unpurified coal gas, though free from the fogs of tar and light oils, a condition which is likely to be necessary if and when the process is perfected. The next stage will be that of a pilot plant, the possible broad outlines of which have been sketched out by the authors. It is gratifying to find that they anticipate success with the usual combination of sulphiding and oxidation. And they visualise that the new purification plant will be operated in conjunction with a sulphur extraction unit so that the whole will be self-supporting in oxide. It would be easy to enumerate some of the troubles which lie before our research workers. They appear to be quite aware of them and to be ready with some at least of the answers. These two communications exhibit a satisfactory attitude, with solid achievement so far, on the part of the Gas Research Board and there should and must be the greatest confidence throughout the industry that this most important work, the removal of difficulties from the existing process of oxide purification and the development of new techniques, will be pushed through to success, and that within a satisfactorily short time.

VERTICAL RETORT DESIGN

ONE may doubt whether the word 'research' is properly applied to such observations as are recorded in the paper which Dr. Burns and Dr. Weston gave to the Institution of Gas Engineers at the research meeting last month. The reasons for promoting any change in design must be founded, we venture to suggest, on observations of the results and difficulties encountered in the full-scale operation of such a piece of apparatus as a vertical retort. And the risks in making a change of design in a vertical retort are considerable. There is first of all the risk that it may not work at all, involving costly rebuilding. The advantages, if any, of a change in design will not generally be fully revealed in a short period. Ease of working may be balanced by reduced thermal yield per ton and/or retort. Increased yields may be cancelled out by higher maintenance costs. All these may vary either way with the coal carbonised and the calorific value of the gas to be made. In one sense the engineers of the former Gas Light and Coke Company (now merged in the North Thames Gas Board) are in an incomparable position to give a reasoned account of their experience with the two leading systems of continuous carbonisation in vertical retorts. But in another sense their experience is narrowed down to conditions in which no great advantage, if there is any in their case, can be taken of the practice of steaming, as well as by the fact that they are to a large extent confined to the use of sea-borne Durham coal.

The over-riding reason for giving any taper at all to the vertical retort is to ensure the downward passage of the charge. It is equally obvious that, in view of the low conductivity of coke, the taper should be the minimum that can be given with complete safety in this respect because the time of heat penetration to the core will condition the throughput and thus the output per unit as well as possibly the fuel consumption and the yield per ton. That it may also affect the flexibility with regard to steaming is suggested by one of the observations in the paper.

The practice of designing with a quick taper at the top,

changing to the parallel or near parallel lower down, was no doubt founded on the fact that the charge of coal tends to swell rapidly on heating, while that of coke tends to contract. This practice has not been followed by designers of other systems, who have consistently adhered to the constant, or nearly constant, rate of taper, and it is interesting to note that development in this particular application (and we must stress the last three words) has tended to the same practice.

In the determination of the profile of a retort there must also be taken into consideration the question of the extent and position of the pasty layer which must somewhere come into contact with the walls of the retort. It can be dealt with by the provision of a quick taper at that point, but it is no doubt better dealt with by the provision of an adequate outside temperature at that point. It is possible that the newer heating techniques applied to the rectangular type of continuous vertical retort have had this latter effect. For the same reason we hesitate to accept to the full arguments based on results as far apart in time as 1931 and 1948. The fact that the results set out, with Yorkshire coals, are so very much nearer together might be explained by the generally easier working of these coals as compared with the Durhams.

It is interesting by the way to compare these comparisons with those of Dr. Pexton between the 'straight' and 'bell-mouthed' retorts of the other system (shall we call it the 'curvilinear continuous vertical retort'?). Here, there was very little difference except with regard to fuel consumption and this was attributable to the extra pre-heating of the secondary air at the base of the retort; in other words it probably had nothing to do with the profile of the retort. Dr. Pexton ascribes the considerable economies effected in continuous carbonisation by the end of 1943 to this additional heat recovery from the outgoing coke and to the introduction of the lambent system of heating—counter-current to coal travel. This counter-current of heating gases to coal travel is now characteristic of both systems.

The considerations which go to the determination of the correct internal profile of a continuous vertical retort are many and varied. Some of the changes shown in the diagrams of the paper by Dr. Burns and Dr. Weston no doubt arose (as in one case Mr. Finlayson said it did) out of drawing office devices to work in existing or standard top or bottom fittings. But apart from these accidents it is possible that there is just one taper perfectly suited to each major class of coal operating under one set of conditions. It is only so great an undertaking as that of the biggest unit of the North Thames Gas Board that could afford to have a retort specially made for it. Commercial considerations cause the constructor to standardise as far as possible the main body at any rate of the retort to suit the average requirements. The general success with which this policy has been attended over the past, say, 30 years does not lead to the supposition that there is anything much wrong with it. To establish this point would necessitate, not research, but the careful collection and correlation of a vast mass of recorded observations and results.

INDUSTRY AND THE UNIVERSITIES

THE relative value to industry of the graduate technologist and the man who has gained his theoretical knowledge through part-time study during and after his work has long been the subject of debate. It was discussed recently at the International Gas Conference when Dr. P. C. L. Thorne mentioned that an investigation some years ago found that about 2% of those in the higher ranks of the gas industry entered as graduates and that all the others were produced by the method of training outlined in his paper. We have no intention of resurrecting this theme again; suffice it to say that the closer integration of the gas industry will call for a far greater breadth of vision and understanding from its leaders not only in the technical problems involved, but also in administration, than heretofore. In this we are reminded of the almost prophetic words of Dr. D. T. A. Townend when he anticipated in 1942 that 'conditions after the war will brook little industrial inefficiency . . . it is quite clear that new developments will call for an influx into the Industry of an adequate amount of the best young brains in the country. It is equally clear that while there will be many openings for men of many different types of training to meet the needs of the commercial, administrative and technical branches, training on the technical side will call for a broader outlook and a product of higher calibre.'

It was therefore with some interest that we noted a recent editorial article in *The Times* on the universities and technological training, and its resultant correspondence. The editorial rightly stressed the importance of Sir John Anderson's speech at the London University graduation ceremony in which he warned against two dangers arising from the swelling size of the universities—the cheapening of university degrees, and the diversion of universities into purely utilitarian activity, financed largely from outside sources. *The Times* went on to comment: 'Whatever the standards of the students there is little doubt that in most universities they are receiving an education in crowded conditions from overworked teachers.' Few would disagree with that opinion, but it was followed by what can only be termed a thoroughly illogical conclusion that one answer to university overcrowding lies in the diversion of student technologists to good technological institutes, a transfer which, it was asserted, would be in their own interests. The effect of recognising the urgent need for more technicians and scientists as expressed in the Barlow report had resulted in swelling the size of the universities and altering their character by filling them with students who were not pursuing the liberal studies, which universities should provide, but were applying themselves to a specialised professional training out of tune with the university spirit.

The answer to this proposed segregation of the technologist was not slow in coming; in letters published on December 3 and 6 Mr. G. W. Carter, Electrical Engineering Department, Leeds University, spoke of the great injustice of depriving the technologist of the widened interests which grow naturally when students of many disciplines consort together, and suggested that the universities must encourage some growth on their technological

side, just as, in past times, they had allowed other growths to meet the needs of other days; Professor Ubbelhode, Belfast University, also referred to the narrowing of opportunities for becoming aware of the diversity of knowledge, and suggested that 'any further stiffening of the social attitude that universities are "socially superior" must lead to the deflection of students from their real vocation as technologists and from rendering maximum service to the community;' and the Provost of University College, London, provided evidence of the active participation by engineering students in the many-sided life of a resident university.

All these criticisms are, we believe, valid and to the point, but the real answer to the editorial has been provided by industry itself in replies to a questionnaire sent out by a working party of the Federation of British Industries to find out the experience of firms in the employment of graduates. The working party summarised the qualities and characteristics sought by industry in its graduate recruits from 43 replies covering firms employing more than half a million workers, including over 8,000 graduates. Apart from the training graduates have received in the fundamentals underlying the scientific training or technical jobs they are required to do, they must possess 'power of leadership, ability, willingness to accept responsibility, breadth of outlook, clear thinking, and logical approach to problems. While the graduate's degree is a reliable indication of a trained mind, this in itself is seldom sufficient. Other characteristics and personal qualities are required to support this and are usually just as important.' From this it seems clear that industry demands more than technical efficiency from the graduate technologist; the 'breadth of outlook' required will not, we believe, be found in the splendid isolation of the scientific mind.

Personal

Mr. **S. Tomlinson Jones** has been appointed Engineer and Manager to the Stratford-upon-Avon District of the West Midlands Gas Board. For the past three years Mr. Tomlinson Jones has been Engineer and Manager of the Leek undertaking. He went to Leek from Oswaldtwistle, where he had previously been Engineer and Manager. He received his early training at Colwyn Bay, followed by an appointment at Falkirk.

Mr. **A. Gardner Kerr,** Technical Assistant at Tradeston gasworks, Glasgow, has been appointed Senior Technical Assistant to the Hamilton undertaking, Lanarkshire Group, Scottish Gas Board. Mr. Kerr, who served as a Petty Officer in the Navy during the war, has this year been elected Assoc.M.Inst.Gas E., and gained experience in both distribution and manufacture of gas while employed by the Glasgow Corporation Gas Department.

Mr. **C. Tuson,** A.M.I.E.E., is retiring on December 31 from the Board of Keith Blackman, Ltd., owing to ill health. Mr. Tuson joined the Company in 1897 and was elected to the Board in 1921. The two vacancies in the Directorate caused by Mr. Tuson's retirement and the recent death of Mr. C. J. A. Galloway have been filled, respectively, by the election of Mr. **G. S. Teggin,** M.SC.TECH., Chief of the Contracts Department, and Mr. **W. G. Calder,** Manager of the Arbroath works. These appointments will take effect from January 1.

Mr. **David Green,** who recently retired from the position of Engineer and Manager, has been presented with a gold wristlet watch by the staff and employees at the works of the West Bromwich undertaking as a mark of the esteem in which he was held for nearly 40 years.

COVENTRY PRESENTATIONS

Presentations were made on December 10 by Mr. A. E West, Engineer and Manager, Coventry District, West Midlands Gas Board, to Mr. **J. E. Wakeford,** Divisional Manager, Birmingham Division, Mr. **J. Swan,** Deputy Secretary, West Midlands Gas Board, and Mrs. **I. Yates,** Home Service Advisor, Coventry District, as a mark of appreciation by the Coventry staff, the two former leaving Coventry to take up their present appointments, and the latter having resigned on her marriage. Mr. West referred to the services which each had rendered to the Coventry undertaking, and wished them all success in their future spheres. Replying, Mr. Wakeford said the credit should go to the staff of the undertaking who had worked so hard and loyally to bring the Coventry undertaking to the forefront. Mr. Allen, Divisional Manager, endorsed all that Mr. West and Mr. Wakeford had said. The schemes that had been evolved prior to nationalisation were good and there was no reason to believe that they should not reach completion under nationalisation. Members of the executive and staff joined in wishing success and happiness to the three recipients.

Obituary

Mr. W. Ralph Herring.—We have just learned of the death on November 26 of Mr. W. Ralph Herring, M.I.C.E., at his home in Perth, Western Australia, at the age of 84. Mr. Herring was Chief Engineer and Manager with the former Edinburgh and Leith Gas Commissioners and a prominent member of the gas industry in the early part of this century. The son of the late Mr. Raphael Herring, who was intimately connected with the industry, he commenced his career in 1884 as Draughtsman and Assistant Engineer at Hastings, and was appointed Assistant Engineer and Manager at Huddersfield in 1891. From Huddersfield he went to Scotland as Engineer with the Edinburgh and Leith Gas Commissioners in 1897. In this capacity he was largely responsible for the lay-out and development of the Granton works, and his advice and experience as a civil engineer contributed much to the growth of the industry in Scotland during and immediately after the turn of the century. He retired as Chief Engineer and Manager in 1910 to take up consulting practice in London, but his services were retained by the Commissioners in a consultant capacity until 1921. In his later years, prior to his going to Australia, his time was devoted to administrative duties in the engineering field, his last service to the gas industry being in 1932 when he advised on the planning and construction of the new gasworks at Johannesburg. Mr. Herring was the author of many books on the construction of gasworks, and acted as an expert witness for the industry in the framing of Parliamentary Bills. With his death and that of Mr. James Jamieson the industry has thus noted in recent weeks the passing of two men on whom it can truly be said the strength of the industry in Scotland, and in Edinburgh in particular, has been built.

Diary

Dec. 29.—North Thames Gas Consultative Council: Monthly meeting, St. Ermins Hotel, Westminster, 2.30 p.m.

Jan. 10.—Midland Junior Gas Association: 'Benzole Recovery by Activated Carbon,' H. L. Fielder (Worcester).

Jan. 11.—Wales and Monmouthshire Junior Gas Association: Whole-day Meeting, Port Talbot. Paper by R. H. Hanford (Port Talbot). Afternoon tour of Abbey Works, Steel Co. of Wales.

Jan. 11.—Western Junior Gas Association: Visit to Gloucester gasworks. 'Distribution Problems and Developments at Stroud,' F. W. Nichols. Showrooms, Gloucester.

Jan. 13.—Scottish Junior Gas Association (Western District): 'Pressure Holder Installations,' A. Austin and A. Johnson (Whessoe, Ltd.).

Research in Industrial Enamel Finishes

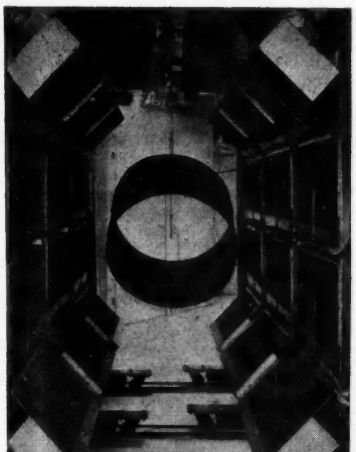
Donald Macpherson and Co.'s New Department

THE opening of a new industrial finishing and development department at the Mitcham Works of Donald Macpherson and Co., Ltd., marks another stage in the long history of the Company's service to the gas industry. It was in 1885 that Donald Macpherson founded the firm and began production of the original Foochow enamels, in which was developed a particularly hard and beautiful lustre. The beginning of the firm's association with the gas industry was in 1890, when special paints were introduced for gasholders, scrubbers, purifiers, and many other types of gas plant, as well as meters, cookers, and fires on the appliance side. In the years following 1925, when the Mitcham works were opened, rapid headway was made with the improvement of anti-corrosive paints, and a better range of colours than had been possible with the old red oxide was soon available for gasworks use.

Donald Macpherson and Co. were among the first to appreciate the value to the gas industry of synthetic enamels giving heat-resisting finishes which would be simple to apply and would demand only short stoving times at modern temperatures, and by means of which bright-coloured appliances could be placed on the market by gas undertakings. The industrial finishing and development department, which was opened some three months ago, is a logical development of this service to industry.

Work of the Department

The work of the department comprises the treatment of samples from customers, many of whom are now demanding specialised formulations, and



The Miel and Spencer adjustable infra-red oven with a large cylinder passing through on the conveyor.

the provision of service and advice on the complete finishing process, from metal pretreatment to the final article after it has been stoved; it is also at the disposal of the Company's own technical staff, and affords facilities for the specialised training of outside technical representatives.

The equipment which has been assembled in the department is representative of the plant which is used in a variety of industrial applications. In particular, the assembly of stoving ovens, which includes a Ballard hot-air oven, a Matthew Hall infra-red tunnel, a Miel and Spencer adjustable gas infra-red oven, and a G.E.C. radiant heating oven, is so arranged as to give both a degree of flexibility in the handling of articles of any size and ease of production by means of a slow-moving conveyor belt.

The Ballard gas oven, which is of the convected air type, provides a range of temperatures from 240 to 400°F., and is particularly suitable for stoving when articles of assorted sizes or shapes have to be treated.

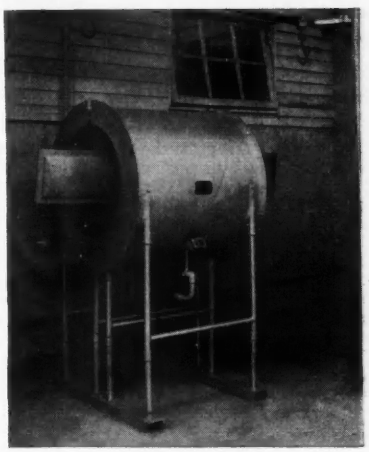
The gas infra-red oven, a photograph of which is shown on this page, is mounted on runners which enable the heaters to be moved backwards or forwards according to the size of article passing through on the conveyor, and incorporates 24 individual unit heaters manufactured by Bratt Colbran, Ltd. The heaters are in two banks of 12 panels, each of which has a radiating area of approximately two sq. ft. and a gas rate of 30 cu. ft. per hour. An independent control cock for each panel together with a pressure gauge and additional control cock for each bank of four ensures a high degree of accuracy in the adjustment of temperature.

Advantages of Gas Heating

The staff of the department, with experience of both the gas and electric types of oven, are of the opinion that the gas heated type has a definite advantage in that the cost of operation and maintenance charges are lower. The periodic cleaning of the lamps is an additional disadvantage since similar treatment is not necessary with the black vitreous enamelled surfaces of the gas heater panels.

Other equipment in the department includes a spray booth with a direct exhaust by a six-bladed fan and a centrally situated airlift table, and a number of small gas-heated tanks for the pre-treatment of a variety of metals.

Research work by the Company has produced in the last six months a new type of gas-fire lacquer which has a considerably higher heat resistance and a fast stoving time of 30 minutes at 250°F. in a convector oven or 2½ minutes in an infra-red oven. Further recent developments of interest to the gas industry are a new 'Snappol' meter enamel which 'flashes off' in 30 minutes and air dries in an hour, available in the usual variety of colours, and a white undercoat for refrigerators which air dries sufficiently hard within an hour for a second coat to be applied. These



A Matthew Hall 2 ft. infra-red oven at work in the Department.

are supplementary to the well-known range of Mikalor paints for gasholder protection, and form a valuable addition to the wide variety of products of the Company which are available for the gas industry.

Bournemouth Gas Values

Bournemouth Gas and Water Company is to receive £3.2 mill. of Gas stock under Section 30 (1) (a) of the Gas Act. The proportion of its gas interests has been determined as 83.83%. The following list of values for the Company's securities, issued by the Ministry of Fuel and Power on December 14, raises the total compensation to composite companies from £2.6 mill. to £5.8 mill., and the number of composite stocks dealt with from 33 to 44. Some 18 remain to be assessed.

Security	Compensation value
5% Irred. Deb.	£131/10/–
4% Irred. Deb.	£104/10/–
3% Irred. Deb.	£92/10/–
4% Red. Deb.	£101
3½% Red. Deb., 1954	£100/10/–
3½% Red. Deb., 1972	£97/10/–*
6% Pref.	£137/10/–
4% Pref.	£113/12/1†
4% Red. Pref.	£101/4/11*
5% Stand. (Sliding Scale)	£185
7% Max. Div.	£160/10/–

* The value of these securities has been determined as the average price of issue ascertained in accordance with Section 25 (5) of the Act.

† The price of issue of the securities of this class issued in December, 1946, has been taken into account in determining the value of the whole class.

Mr. Leslie Hardern, Public Relations Officer to the North Thames Gas Board, addressed the Women of Today Club on points to look for and points to avoid when buying equipment for the home.

Southern Area's 600 Different Tariffs

Steps Towards Uniformity of System

MR. O. R. GUARD, Chairman of the Southern Gas Board, gave an outline of the board's policy in regard to prices and tariffs to the Southern Gas Consultative Council at its second meeting, held on December 14 at the Social and Welfare Club of the Reading undertaking, under the chairmanship of Alderman J. W. Moore.

Mr. **Guard** said that since the first meeting of the consultative council the board had progressed a little more quickly than he had dared to hope, and had now in mind certain prices which it wanted to vary. The variations suggested were not at this stage designed to increase the board's revenue; they were designed to get rid of anomalies in various parts of the area. The immediate step was only a very short one, involving alterations in advertised prices. The board had discovered upwards of 600 different types of prices, tariffs, and methods of charge throughout the area. The consultative council would appreciate that that was a matter that needed really careful study. The tariffs had been built up by the 60 odd different undertakings and bore no relation one to the other.

New Burdens

The board proposed to investigate the whole system of charge with a view to bringing in a uniform system; he emphasised the word 'system' because at present they could not contemplate the establishment of a uniform price. On ordinary economic grounds they could not for many years look forward to a complete unification of prices, but unification of system was more possible. The Divisional General Managers and the Chief Accountant had been studying the problem and the board hoped to be able to introduce some measure of unification of system to come into operation on January 1, 1951.

There were two reasons for waiting until that date. One was the matter of increase or decrease in overall costs throughout the area. The board wanted to be in the position that when it had any major variations within or outside its control it could deal with them in a way that was fair to all the consumers; any *ad hoc* change now might be very unfair to some and unduly advantageous to others. They had had two serious blows to their economy other than those to which he had referred when he addressed the consultative council at Bournemouth in September, namely coal prices and the coal freight subsidy.

Savings Offset

The first was that the price of gas oil had advanced very seriously as a result of devaluation. He could only quote an approximate figure, but the increase looked like costing the board an additional £50,000 a year. The second blow was the threatened increase of 16⅔% in railway charges for mineral traffic. The council would appreciate that the board was to some extent fortunate inasmuch as it had converted as much as possible of its coal tonnage to sea transport, bearing in mind the advantages in that respect of those of its undertakings situated near the sea. The increased cost of coal inwards and coke outwards, however, would probably exceed £100,000 a year.

The board had not taken those items into account at the present stage, preferring to wait and see what it could do about them and being determined to run for the next 12 months or so until it was able to present a fuller picture of its financial position. The board did not yet know what its interest charges would be, nor what would be the final agreement nationally on depreciation. He had referred at the previous meeting of the consultative council to possible savings in operational costs which appealed to him as being preferable to the simpler process of increasing gas prices. The board had completed arrangements for the shipping and purchasing of coal, and it had completed arrangements in connection with the internal movement of coal which in a full year were estimated to show a saving of approximately £125,000. That was all to the good, but the council would appreciate that it was all very depressing and frustrating that, having got under the skin of this problem of economy, the board was faced with the prospect of fresh increases in costs.

Everything that had been said about increased prices so far had been brought about by things outside the board's control while it was in fact making operational savings on the things within its control. There might or might not be some measure of comfort in the thought that the increased charges to which he had referred were going to assist other nationalised industries.

The First Steps

Coming to the question of immediate price changes, he said the board was reducing the price in some 16 or 17 undertakings—in some cases by quite considerable amounts—where costs bore no relation to selling price, and in other cases it was making comparatively small upward adjustments. The object was to get districts reasonably into line with each other and to get rid, as far as possible, of a lot of rather peculiar price variations of small fractions of a penny. The elimination of those various fractions would make things simpler for the consumer and would save a great deal of man-power on the accounting staffs. Having regard to what had happened in the South Western area on the question of price increases, the Southern Gas Board had taken the utmost care to see that the requirements of the Gas Act were complied with, and the price variations would be duly published in the proper form.

Turning to the question of general progress, Mr. Guard told the council that the board was planning integration on a fairly wide basis, but development might be held up for some time by shortage of pipes. With 12 area boards all in the chase it was fairly obvious that actual production would lag behind their requirements for some time to come. The board, however, was dealing first with the most urgent link-ups and with those works which were in a poor state and on which it would have to spend capital sums to keep them alive at all. There were other plans which might sound more grand but which would not be so important or effective in practice, and these would have to wait. The board had already closed, down two extremely extravagant works both small ones; there were others which could never hope to produce gas competitively or economically on their existing capital basis, and money would have to be spent on them to make them efficient.

Economy Campaign

The board had spent considerable capital sums this year literally on trying to ensure the supply of gas at all in a number of districts. 'I must be frank,' continued Mr. Guard, 'and tell you that a number of the undertakings were in a deplorable state. We took first things first and laid on teams who have worked like slaves so that we may feel fairly confident about the winter. The present state reflects enormous credit on the maintenance teams who have been round and done their job.' As to the effect of the national economy campaign Mr. Guard said the board was playing its part. The members realised that these economies were vital to our national survival, and he proceeded to quote from a report which he had put in at the highest level. The board had re-screened its whole capital programme since the Prime Minister had appealed for economy, concentrating on those schemes that were necessary to make up leeway and to improve working conditions on a number of inefficient undertakings to ensure as far as possible a supply of gas during the winter. Capital projects, whether by way of integrations or extensions of works, were authorised only on the basis of profitability in connection with long-term maintenance. In connection with revenue expenditure the board had economised in administration, in the transport and handling of coal, and in a complete re-organisation of financial control.

Finally Mr. Guard said that the board had steadily improved the quality of the gas it was sending out. It had been found that in the very small undertakings the quality of the gas was not up to the standard of the larger and more efficient undertakings and steps had been taken to improve the standard generally.

A cordial vote of thanks was accorded to Mr. Guard for the information he had given to the council. In returning thanks he said the board could not work miracles but it would continue to try to do so.

Housing Estate Problem

Arising out of a report from the divisional committee attention was drawn to the question of a gas supply to 12 houses on a council housing estate at Goring-on-Thames. The local authority proposed to erect a further 38 houses but owing to the fact that there was no drainage on that part of the estate the further development was not likely to be proceeded with for some time. Meanwhile it would not be an economic proposition for the area board to run a main to supply the present 12 houses unless the council agreed to bear part of the capital cost.

It was reported that local authorities, chambers of commerce, and other organisations had been notified of the constitution of the council and the local committees.

(*Continued at foot of page 713*)

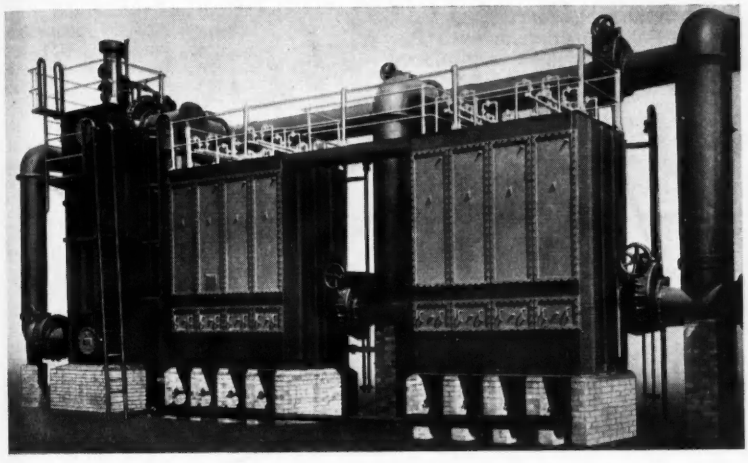
Darlington Works Visited

Representatives of the staff and works of Whessoe, Ltd., Darlington, recently visited the Northern Gas Board's Darlington gasworks. The visit was arranged by courtesy of Mr. F. Wilson, the General Manager of the Darlington Division, and was organised by Mr. Hindle, the Engineer and Manager of the Darlington Undertaking. Over 40 members of Whessoe, Ltd., attended.

The object was to give an insight into the layout of a modern medium sized gasworks, the peak daily output from which now exceeds 7 mill. cu. ft., to a representative group of the Whessoe organisation. Those attending mainly comprised members of departments which, while actively engaged on work for the gas industry, seldom have the opportunity of visiting a gasworks and of seeing the results of their work, and included estimators, draughtsmen, fitters, and boilersmiths.

A large proportion of the plant inspected has been supplied by Whessoe, including more recently a 3 mill. cu. ft. spirally guided gasholder in a welded steel tank, complete with an Elliott system of remote indication of gas pressure and stock; a modern set of welded steel deep-box purifiers and a W.W.-D. electro-detarrer with an eight-bay static ammonia scrubber (illustrated in our photograph), as well as many older items of plant, including vertical tube condensers, purifiers, and gasholders.

The visit was followed by tea, when the guests were welcomed by Mr. Wilson and a vote of thanks to the management and guides of the undertaking was proposed by Mr. K. W. Francombe on behalf of Whessoe, Ltd., who emphasised the mutual inter-dependence between the supply side of the gas industry and the contractors.



The W.W.-D. electro-detarrer with eight-bay static ammonia scrubber.

(*Southern Tariffs—Continued from page 712.*)

A question arose as to whether further publicity should be given to the names of the local members in the Press, on notice boards, and on the meter cards. Two members whose names had been published locally told the council that they had been inundated with communications, and after some discussion it was decided to take no further steps to publicise the names.

Another matter that arose on a divisional committee report was the question of the maintenance of gas operated refrigerators. It was stated that in the case of some of the older patterns the area board's officials had informed consumers that the refrigerator makers had declared that the patterns were obsolete and spare parts were therefore unobtainable. Mrs. Oliver, Deputy chairman, said this was particularly unfortunate for people of the lower income group who had purchased refrigerators on hire-purchase terms and were unable to afford new appliances at post-war prices. Members suggested that certain spare parts might easily be made in the area board's own workshops. One member cited the case of his own refrigerator which, having been condemned as obsolete, was now working as well as when it was new as the result of the fitting of a very small part made by his local gas undertaking. It was agreed to ask the area board to explore the possibilities of developing such a service.

From the western divisional committee there was a complaint of lack of maintenance facilities, particularly for water heaters, in one locality. The local member said that it was not only a question of having a fitter available. If consumers could be supplied with spare parts they could do minor repairs themselves.

The Chairman reported that a question had been raised about the meters supplied on housing estates. In some cases where prepayment meters had been offered, the tenants preferred quarterly meters. While one of the objects of installing slot meters was to avoid bad debts, the area board's answer to the question was that the individual gas consumer should have free choice of the type of meter installed.

Under the heading of correspondence the Chairman stated that letters had been received from three Members of Parliament in the area, all on the question of legality of notices relating to alterations in price, and a suitable reply had been given in each case.

Pressure of Gas in Glasgow has been temporarily reduced. Mr. D. F. Young, Divisional Controller of the Scottish Gas Board, announced that plant which has been under repair at Dalmarnock and Provan gasworks would shortly come back into production and normal pressure would be resumed. The cause of the reduced pressure was that repairs to coke ovens at the Provan Iron Works of Wm. Dixon, Ltd., took longer than expected. Resumption of production by the plant at Dalmarnock and Provan would provide 3 mill. cu.ft. more per day.

Record Coal Output

The total output of coal last week, including the opencast yield, at 4,598,300 tons, was the highest since June 22, 1940. The aggregate total of mined coal in the 49 weeks of this year amounts to 191,486,400 tons, an increase of some 5,300,000 tons compared with the same period of 1948, and is only 10.5 mill. tons below the minimum target of 202 mill. tons for the year. During the week ended December 3 output per manshift both overall and at the face reached all-time records, at 1.22 tons and 3.14 tons respectively. In the same week total manpower increased by 300 to 709,000, but the number of faceworkers declined by a 100 to 293,500. In the week ended December 9, 11,687.5 mill. cu.ft. of gas was available at gasworks, against 11,546.1 mill. in the previous week, and the total of electricity sent out for public supply increased by 700,000 units to 1,061.7 mill. units over the same period.

Glasgow Prices

A plea that the proposed increase in the price of gas at Glasgow next year should be reconsidered was made on December 13 to the Scottish Gas Board by a deputation from Glasgow Corporation. The board announced recently that the price of gas at Glasgow would be increased by approximately 7d. per 1,000 cu.ft., and Lord Provost Victor Warren, putting the case for reconsideration of the proposed increase, said that the weight would fall largely on a class least likely to be able to bear it.

On figures adduced from the accounts of Glasgow Corporation Gas Department for the period ended April 30, 1949, he argued that the increase might be restricted to 4d. per 1,000 cu.ft. He suggested that the reduction could be made by taking into account in the first year the value of unmetered gas, which was estimated to be worth £250,000 at that date.

A joint statement issued after the meeting said it was generally agreed that some increase was inevitable in the present circumstances. The deputation suggested that the board might consider the spreadover of the operating losses for this year to a longer period than that in their present proposals and so reduce the initial increase in the price of gas.

Sir Andrew Clow, on behalf of the board, indicated that the representations would receive careful consideration and promised to advise the Lord Provost of the board's decision.

Justice and Compensation

Minister Rejects Gas Stock Proposals

THE Opposition's proposals to remedy an alleged injustice to gas shareholders occasioned by the issue of depreciated British Gas stock at par in payment of compensation were debated at length in the Commons on December 12. The motion was defeated, as reported in the *Journal* last week, after Mr. Gaitskell, the Minister of Fuel and Power, had maintained that there was no serious hardship and had condemned the motion as both impracticable and undesirable.

The debate was opened by Col. **R. S. Clarke** (C., East Grinstead), who emphasised that the order in which the injured persons had been placed in the motion—creditors, co-partners, and shareholders—reflected the order of priority in view of the injury they had sustained. The position of creditors of companies taken over was particularly unjust. They had made a loan, usually for a short term, and were assured of a return of the money, only to find on nationalisation that all they got was British Gas stock which they could not sell without a loss. The absurdity arose because the financial position depended entirely on when the stock was issued. A matter of a few months could make 10% difference in the amount received. There were, he suggested, three main remedies. First, an amendment might be made to the Gas Act whereby the valuation might be arranged to be made at the date of issue ; secondly, the Minister could agree higher compensation values for securities as they were taken ; and finally, there was the remedy suggested in the motion, that of issuing a very short-dated stock.

Sir **John Mellor** (C., Sutton Coldfield) thought that the method of manipulating the gilt-edged market adopted by the Government, which kept it steady before vesting day and left it to find its own level afterwards, was unfair to the holders.

Mr. **Emrys Hughes** (Lab., Ayrshire S.) was in favour of asking the wealthier owners of Gas stock to defer their demands until the nation was out of its present economic and financial crisis.

Mr. **E. Fernyhough** (Lab., Jarrow) said that the Opposition, who plastered the hoardings to show how much the nationalised industries had lost, were hypocritical if they then pleaded for a bigger burden to be placed on those industries.

A Broken Pledge

Such short contributions were the preliminary skirmishes which preceded the real attack on the Government which was made by Lieut.-Colonel **W. Elliott** (Scottish Universities). He reminded the House that the Minister of Fuel and Power had given a pledge that the holders of compensation stock should be able to sell it at no very great loss. 'I say that that pledge has been broken and it is a matter of the Minister's personal honour.' Deeds spoke louder than words, he continued, and said that the Government's action in insisting on giving compensation that was less than it thought just when the Act was passed had tarnished its gilt-edged stock and had helped to lower the international credit of the country.

In reply, the **Minister of Fuel and Power** (Mr. Gaitskell) said that he had seldom heard such an outburst of indignation and fury, which seemed to him 'a little synthetic.' He said that gas shareholders were well aware from the outset that they would be subject to the rise and fall of the market. He found it hard to believe that a motion demanding repayment from the shareholders, had the market gone the other way, would have been brought forward by the Opposition.

Dilatory Negotiations

The Minister claimed that the time taken in completing the valuation of the shares had not been very excessive. 'In so far as we have not gone faster, I must say that it is not due to any failure on the part of the Ministry. We have found that the representatives of the stockholders have not displayed any particular eagerness to open negotiations. Again and again we have had to take the initiative in order to get the matter settled.'

As far as co-partnership was concerned, he had two points to make. First, unlike the normal stockholder, co-partners as a rule had not been able to dispose of their holdings when they wished ; they did not obtain full control until they retired or left the company. Secondly, because the co-partnership schemes were going on until 1951 co-partners were bound inevitably to hold on to the compensation stock. 'They were primarily interested in income which is not affected by the change in gilt-edged prices, and therefore I do not think that there is any special grievance there.'

Turning to the Opposition's suggestions, he said that they were impracticable because to carry them out would mean tracing every transaction in gas stock by the original holder and then determining how much loss had been suffered, if any. It was a most dangerous principle to ask that, because gilt-edged had moved in a particular direction, there should be some change of a retrospective character so far as the Act was concerned.

Finally, he declared that the holder of unquoted shares was the type who was not in the habit of selling. It was true that he now got a lower income, but it was a much more secure income. If the Opposition arguments were followed, the holder would have realised the value of the shares and put it into some other industrials which afforded a yield something like the stocks which they had held before. Industrial equity stocks had also fallen, however, by just about the same amount in the last six months. He did not think that there was any case of real hardship.

Chemical Engineers

The Examiners' Report, issued by the Institution of Chemical Engineers, shows that there were 115 candidates for this year's Associate Membership examination. Of these, 56 sat for the full examination and 39 for the home papers only, while 20 took from one to five papers as the result of failure in previous attempts. Sixty-one candidates were successful, representing 53% of the total ; of the successful candidates, 23 passed in the full examination, 28 in the home papers, and 10 in the papers which were taken again.

The large number of candidates is an increase of 29 over 1948. The percentage of successful candidates is lower than in 1948 (57%). The standard required is high, and Paper A is a severe test not only of the application of fundamental principles, but of the capacity for orderly treatment and for hard work. Candidates are often at a loss to know how detailed the treatment should be. The answers should follow the lines of an industrial report, where excessive length is not a merit.

There was considerable difference in the standard of the answers. The use of simplified equations from handbooks is deprecated. There was in many answers a lack of balance due to elaboration of unessential details, and sizes of units were often assumed despite the emphasis in the instructions on the use of first principles. The standard of drawing is still low.

The general standard was slightly lower than in last year. There were some outstandingly good papers, but fewer than in most previous years.

Mechanical Handling

A meeting of the Southern Association of Gas Engineers and Managers (Eastern District) was held at Gas Industry House, on November 29, under the chairmanship of the President, Col. J. A. Gould, M.C., M.I.CHEM.E. The colour film, 'Mechanical Handling,' which was sponsored by the Mechanical Handling Engineers' Association, was introduced by Mr. **S. Langford** (R. & J. Dempster, Ltd.), who said that the Mechanical Handling Engineers' Association had felt that on the occasion of the film's showing to a senior association of the gas industry it should be personally represented. Mr. John Drake, Mr. Norman Jenkinson, and himself were, accordingly, present at the meeting, together with Mr. John Bird, who had directed and produced the film. The film was received with considerable interest, and at the conclusion Mr. **S. R. Bullwinkle** expressed the members' indebtedness both to the Mechanical Handling Engineers' Association for their production of the film and to the Association's representatives for their presence at the meeting.

ESTIMATION OF CARBON MONOXIDE*

By L. T. MINCHIN, B.Sc., M.Inst.Gas E., F.I.E.S.

WHEN I worked at the old Watson House in Nine Elms Lane, Battersea, I first considered the detection of carbon monoxide by palladium compounds. We had a request from the distribution department for a means of distinguishing between town gas and other gases such as sewer gas which might be found in subways, manholes, sewers, &c. Since carbon monoxide was the one gas occurring in town gas which was not likely to be present in fermentation gases, this seemed an obvious clue ; and it was well known even then that palladium chloride solutions—and papers dipped in them—darkened when exposed to CO even in small traces. Unfortunately, the paper had to be actually wet ; a dried paper was quite insensitive. This was very inconvenient, but in spite of this the method proved quite useful.

I recollected this experience when some 10 or 12 years later I saw the silica gel tubes which were then being developed at the Royal Aircraft Establishment at Farnborough, Hants. This was in 1942 and the detection and estimation of CO in the cockpits of fighter aircraft was a vital problem, for the exhaust gases were commonly discharged near the front of the fuselage and travelled back over the surface with the slipstream. It was quite possible for sufficient CO from this source to re-enter the 'plane to affect the pilot and impair his faculties, so that tests were continually being made with a view to preventing this defect. For this purpose Mr. Earwicker and Dr. Main-Smith devised a tube containing pure silica gel impregnated with a double sulphite of palladium which reacts so strongly with carbon monoxide that a dark stain is formed immediately which spreads along the tube as the amount of CO goes up. This property is very important, for it enables the *length* of stain to be used as a measure of the amount of CO present ; if the column darkened uniformly one would have to measure the degree of darkening, which would be much more difficult.

In the Gas Industry Today

When I saw this work going on during the war it struck me immediately that such a detector tube would be invaluable in the gas industry, both for tracing leakages of town gas and for detecting incomplete combustion in flue gases or the air of a room. In particular, the possibility of examining a gas appliance *in situ* with an apparatus which indicated straight away whether the combustion was satisfactory seemed attractive in the extreme. As you probably know, the standard method of determining CO in flue gases up till now has been the chemical estimation using heated iodine pentoxide, a relatively elaborate procedure only possible in a well-equipped chemical laboratory. Even there, it is only reliable if checked fairly frequently on standard mixtures. Consequently a portable method of estimating CO in two minutes is something which greatly affects us all.

The type of tube available today is shown in Fig. 1. This tube consists of three columns of silica gel—a central yellow column containing the palladium salt and two outer columns of pure gel which act as a filter and also ensure that the gas sample shall have the correct degree of humidity when it reaches the sensitised column. Made in this way the tube can be used twice by passing the sample first one way and then the other ; this enables two tests to be made for the few shillings expended on each tube. The length of darkening is measured by a ruler (for maximum accuracy one can average the length as measured at four places round the tube) or by a scale printed on the tube.

The Double Aspirator

Such a device is only reliable if one has a means of drawing the correct volume of the air to be tested through it at the right rate, and for this purpose I have designed a portable double aspirator as shown in Fig. 2. The use of a vessel containing water is, of course, very often used for this purpose in the laboratory, but such an arrangement is only convenient where water is readily to hand ; moreover, some time is taken up each time it is used by the need to set the rate and the correct value. In the double aspirator this is done automatically, and as soon as one chamber is empty one can invert the apparatus and carry on as before, since it is completely symmetrical above and below.

Fig. 1

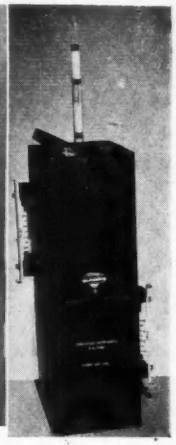


Fig. 2

In a laboratory or test room this device is very convenient and saves a lot of time ; in a road excavation or a coal-mine it can still be handled quite easily, and gives the same accuracy as in the laboratory.

Uses

An obvious application is to appliance testing ; in conjunction with a portable Orsat apparatus the CO/CO_2 ratio can be determined quite accurately on the spot. There may also be occasions when a customer complains of being affected by 'gas fumes,' or the employees in a factory complain of headaches, or someone asserts that there is a gas smell when no leak can be detected. In such cases a simple test with this apparatus will quickly demonstrate if CO is present in sufficient quantities to cause any ill-effects. A concentration of 0.01% can be regarded as completely harmless, and this apparatus will easily detect 0.001% or one-tenth of that amount. A heavy smoker often suffers from a degree of chronic carbon monoxide poisoning corresponding to the continuous inhalation of 0.01% CO in his atmosphere.

A distribution department is likely to find the method useful in cases where the short indicator is not adequate. Up to the present a filter of soda-lime or lead acetate silica gel in a separate tube has been used to remove H_2S, a common ingredient of sewer gas and one of the few gases which interfere with the CO test. Recently, however, I have been experimenting with the dual-purpose tube which will detect both H_2S and CO simultaneously ; I think this may prove very useful to distribution foremen.

On the works, the method enables the atmosphere to be tested wherever CO is likely to be present ; in booster-houses, meter buildings, and on water-gas stages, for instance. It is also most useful if men have to enter an enclosure such as a gasholder or water gas generator, a test of the air being taken to ensure that it is perfectly safe to breathe.

Precautions

The rate at which gas passes through the tube is only 60 c.c./min., so that some care is necessary to see that the

(*Continued at foot of p. 720*

* A Communication to the London and Southern Junior Gas Association, December 9, 1949

INSTRUMENTATION AND GRID CONTROL—SOME FURTHER DEVELOPMENTS*

By L. S. JAMES, M.Inst.F.,
Gas Industries Division, Electroflo Meters Co., Ltd.

THE purpose of this Paper is to give the Wales and Monmouthshire Junior Gas Association an outline of the comprehensive paper given in London in May, 1948. In addition, some further developments relating particularly to new installations in Wales are discussed.

The modern trend towards increased instrumentation and control is equally manifest in every branch of the gas industry. In recent years scientific control has developed with vigour and rapidity as a contribution towards the ideal of optimum economy in gas manufacture and distribution.

Measurements are fundamental to any manufacturing process and instruments are a means to an end; this being cheaper gas, of a constant quality, at correct pressure throughout the district.

Centralised Grouping

Where the result of a valve adjustment is rapid and must be noted by an operator it is advantageous to place a dial indicator nearby to facilitate adjustment. Recorders are usually referred to less frequently and may well be situated with less regard to visibility. For a number of reasons, which should be considered together, it is often preferable to mount recording instruments and sometimes indicators, on a panel which itself is in proximity to the plant concerned. Centralising of instruments is advisable where:

1. The action and operation of plant or apparatus may be better appreciated by the simultaneous consideration of several significant and related quantities,
2. The time saving of skilled personnel in taking periodic readings is a matter of importance,
3. The process or plant concerned is in a dirty or fume-charged atmosphere,
4. The plant is spread over a considerable area.

The tendency nowadays is to take advantage of instruments which provide indication at the point of adjusment and an additional reading (often recorded) at a remote, central point. A common argument against centralisation involves the human tendency of some operators to 'look around the plant as little as possible' during a shift. It sometimes happens, of course, that a comprehensive panel of the 'push-button' variety does encourage the lazy workman. On the other hand, the charts will often reveal such habits to the engineer-in-charge. Moreover, operatives will know that their work is being revealed by the recordings and this may tend to effect improvement.

Automatic Control

The design and installation technique of automatic control equipment is a highly specialised science. The decision to instal automatic control in any given circumstance must be based on the fundamental issue of whether or not the final result produced by such control will surpass that maintained by skilled manual operation. Where plant characteristics (on the works side) or district characteristics (on the distribution side) are taken into careful consideration automatic control nearly always justifies its installation by improvements in operating efficiency and working conditions.

Automatic Control of Steam to Producers

Some excellent results have been achieved on continuous vertical settings by the precise control of pressure in the CO main. The effects of wide variations in volume of producer gas to the setting are well known. The same may be said of varying C.V. of producer gas. Where continuous 'floating' control of the producer steam throttle valve has been provided, constant heat to the setting becomes available and zoning of heat and air-slide adjustment is greatly simplified.

The sensitive, servo-motor relay type regulator which has been employed extensively for this purpose, combines essential sensitivity with inherent stability, *i.e.*, freedom from hunting. The writer has gathered some test results which are remarkable though space does not permit dealing with them here. The producer is a key unit in the economics of carbonising and the success of this control is now so well established as to indicate wide adoption in the future.

Measurements and Control in the Distribution Field

The complexity of many present day distribution systems, with superimposed high pressure feeders, demands a more precise knowledge of the relevant pressures, flows and storage

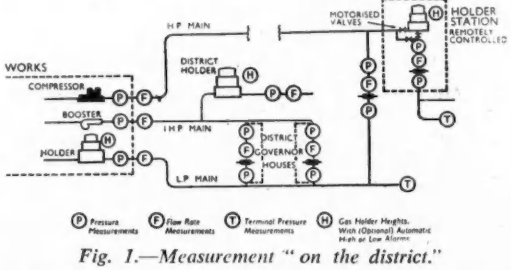


Fig. 1.—Measurement "on the district."

capacities than was ever considered necessary when those systems originated. Moreover, gas distribution in future is likely to be planned on broader lines and many systems will be co-ordinated to cover more extensive areas. The integration and interlinking of undertakings with the possible creation of more 'grid' systems seems to indicate an advance in the technique of control, both centralised and localised.

Fig. 1 shows, diagrammatically, the layout of a hypothetical 'system' showing where measurements can usefully be taken. Of these flow rate measurement requires the most careful consideration.

A flow meter measuring instantaneous rate (in cubic feet

(*Continued from p. 719*)

volume of any rubber tube used to draw in the sample is not excessive. As a general rule, 1½ ft. of 8 mm. tubing is quite all right; for longer lengths one needs to 'diminish down' to 3 or 4 mm. internal diameter. Carbon monoxide is a very common constituent of town air in small traces, so one cannot leave a tube open—one end having been used—for more than perhaps half an hour without taking some precaution to exclude the atmosphere.

Subject to such simple precautions as these, I think you will find the method a very useful one.

The CO indicator is sold by Combustion Instruments. 106, Kensington High Street, London, W.8.

* Abstract of a paper to the Wales and Monmouthshire Junior Gas Association, Newport, December 6, 1949.

per hour) has, fundamentally, a much more difficult task than a volumetric meter of the positive type. Care must be taken to ensure that the differential pressure across the measuring retriction in the gas main is truly representative of the average velocity. This velocity bears a definite relationship to the rate of flow. For this reason the orifice plate is preferably employed to the pitot tube. The latter is attractive for its

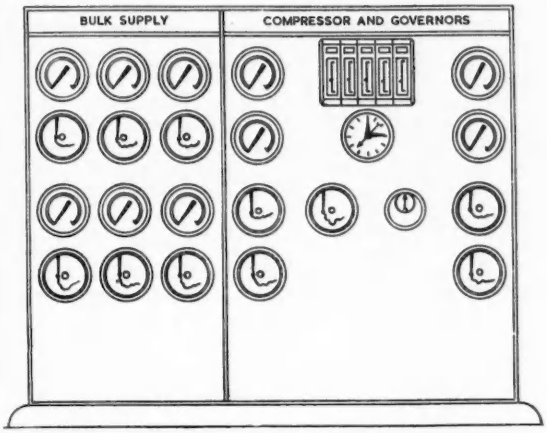
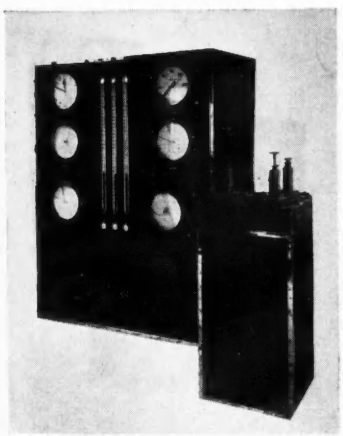


Fig 2.—Control panel to be installed at new works, Pontypool. Instruments: Indicating and recording flow meters; flows to Abercarn, Cwmbran, Blaina and Blaenavon, British Nylon Spinners, Old Pontypool Works, and outlet compressor. Pressure indicators: Outlet compressor, inlet governor, inlet and outlet exhausters, outlet works governors (2). Pressure recorders: Outlet compressors, outlet governors (3), inlet to governors. Gasholder stock indicator and recording and integrating steam flow meter.

ease of installation and negligible resistance to gas flow. But to obtain a reasonable differential or force to operate a commercial meter (say, 1 in. W.G.) a velocity of at least 150 ft. per second is required. Such a velocity is uncommon. The



pitot tube measures velocity at one point in the main, whereas other pressure difference devices average out and provide a velocity head less affected by disturbances to stream-line flow.

When metering compressed gas at the works, the position of the orifice plate must be carefully considered. In addition to flow disturbances caused by bends, tees and valves, pulsations caused by the compressor will tend to create errors. These pulsations cause inaccuracies in proportion to pulse rate and volume. It is impossible to predict with certainty the degree of error from this source. Either the pulse must be damped or the orifice plate installed well downstream where the disturbance will be considerably reduced.

The sketch of the new Pontypool panel, Fig. 2, illustrates a typical layout covering 'gas out of works.' The vertical edgewise pressure indicators incorporate an improved dry type of movement, specially treated to resist corrosion. Those instruments directly connected to the compressor main incorporate damping devices.

Control Panels on Welsh Distribution Grids

A few words on the subject of grid installations in one Wales area will be of particular interest. This particular system which was commenced by the (then) United Kingdom Gas Corporation, arose from a situation in the Dowlais, Bargoed, Romney, and Merthyr areas fully discussed in the paper by Hodkinson and Taylor, 'Area Gas Supply.' The objective is to improve the supply to certain rapidly develop-

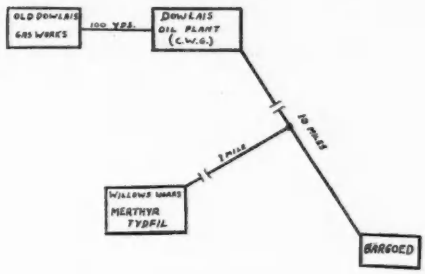


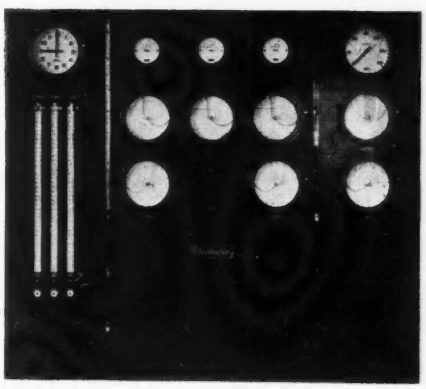
Fig. 3.—Diagram of Merthyr Area.

ing towns while taking full advantage of existing carbosing capacity. It was known that the gas make was barely adequate to meet demands and much plant, such as that at the Quaker's Yard works, was old and inefficient. A ten mile main was laid from Dowlais oil plant to Bargoed, Fig. 3. Coke oven gas from Bargoed was also supplied to undertakings in the Rhymney and Aber Group. Mynyddislwyn, which required increased gas, is supplied by a new main from Bargoed. Yet another supply scheme was based on the coke ovens at Nantgarw colliery.

The instrument panels are installed to improve technical control of the bulk supply to the areas indicated (Figs. 4 and 5). A considerable amount of useful information is thus made available towards the ultimate of improved supplies to important industrial undertakings. Bulk supply is regulated on a

Fig. 4.—(left) Grid control panel at Bargoed.

Fig. 5.—(right) Grid control panel at Merthyr Tydfil.



volumetric basis by Reynolds type governors supplied by the Bryan Donkin Co. In the accompanying picture of the Bargoed panel the volume adjusting knobs are seen, table mounted, on the right. Other panels at Dowlais and Mynyddislwyn are similar to those illustrated.

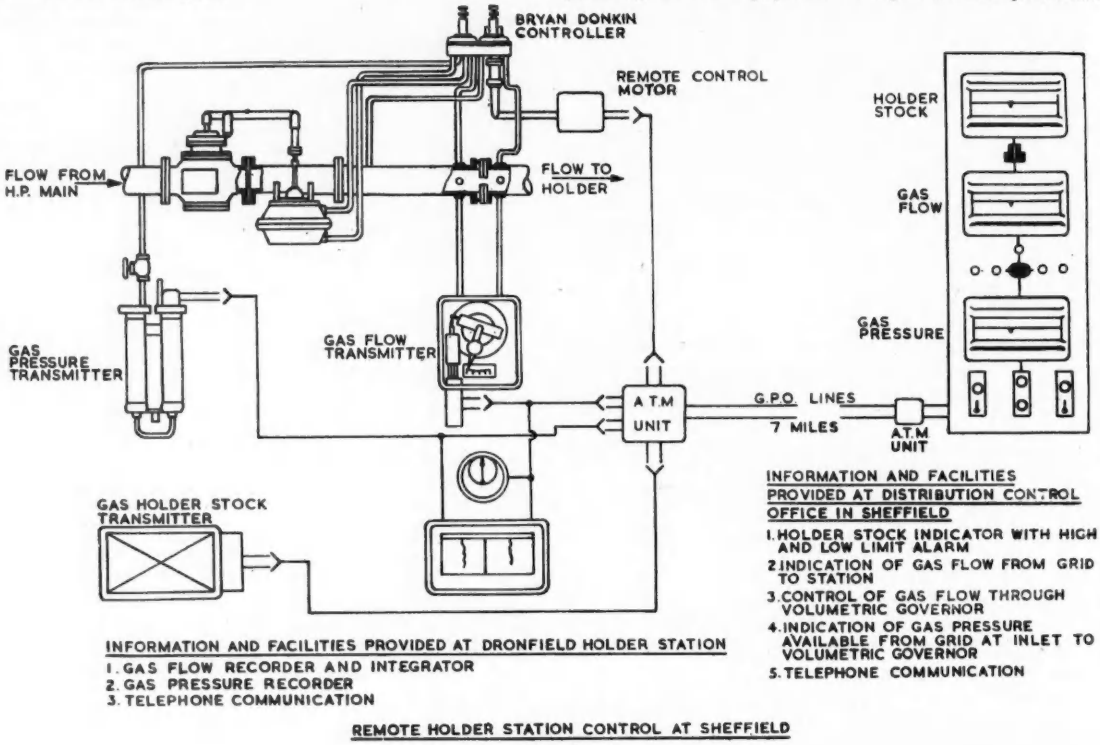
Among recent installations which have proved invaluable in practice is that of the remotely controlled holder station at Dronfield, about seven miles from Sheffield. A short

description of this is of interest because the arrangement is typical of what is so likely to become common-place in the near future.

The Dronfield station supplies up to 300,000 cu.ft. per day to nearly 3,000 consumers. The single lift, spirally guided holder is of 100,000 cu.ft. capacity. The control system ensures that information of flow, pressure and holder height conditions is available in the central control room. Remote control of the volumetric governor through which gas from the grid flows to the station is also accomplished by push-button on the control panel.

The installation has proved very effective in controlling, efficiently, the supply of gas from grid to holder. It has permitted of direct supplies to individual consumers and population centres on the line of grid mains without reducing the load factor of the compressing plant. Much useful information has been gleaned on the movement of gas in the grid and output load factor of the station.

Lastly, a few notes on the important matter of proper initial installation and continued maintenance of control and measuring apparatus. It must appear obvious that if comparatively delicate equipment is to give its best performance


BRYAN DONKIN CONTROLLER
REMOTE CONTROL MOTOR
HOLDER STOCK
FLOW FROM H.P. MAIN
FLOW TO HOLDER
GAS FLOW
GAS PRESSURE
GAS FLOW TRANSMITTER
GAS PRESSURE TRANSMITTER
A.T.M UNIT
G.P.O. LINES
7 MILES
A.T.M UNIT
GAS HOLDER STOCK TRANSMITTER
INFORMATION AND FACILITIES PROVIDED AT DISTRIBUTION CONTROL OFFICE IN SHEFFIELD
1. HOLDER STOCK INDICATOR WITH HIGH AND LOW LIMIT ALARM
2. INDICATION OF GAS FLOW FROM GRID TO STATION
3. CONTROL OF GAS FLOW THROUGH VOLUMETRIC GOVERNOR
4. INDICATION OF GAS PRESSURE AVAILABLE FROM GRID AT INLET TO VOLUMETRIC GOVERNOR
5. TELEPHONE COMMUNICATION
INFORMATION AND FACILITIES PROVIDED AT DRONFIELD HOLDER STATION
1. GAS FLOW RECORDER AND INTEGRATOR
2. GAS PRESSURE RECORDER
3. TELEPHONE COMMUNICATION

REMOTE HOLDER STATION CONTROL AT SHEFFIELD

Fig. 6.

Reference to Fig. 6 will make the various facilities clear. At the holder station, transmitters measure gas flow, pressure and stock. These send proportional electric currents over a single pair of hired G.P.O. lines via relay equipment provided by the Automatic Telephone and Electric Manufacturing Co. At the receiving panel, seven miles away, similar relay equipment distributes the measurements to Electroflo indicators calibrated in units of flow pressure and capacity. Any reading can be selected by push-button, but the line may be left on any one to give continuous display of that measurement. The remote control of the governor is carried out in steps of 1,000 cu.ft. for each operation of the push button. The electric motor turning the governor cam runs for a predetermined fixed period. The holder limit alarms take precedence over all readings and telephone communication. The alarm equipment is battery operated and indication is given if current should be interrupted by a blown fuse or other reason.

At the holder station the gas flow is integrated on a continuous high-speed integrator and recorded on a roll chart of about two months' capacity. A second zone of this chart carries the gas pressure record. The high pressure manometer is of the standard Electroflo type incorporating a 'U' column of mercury measuring the differential between governor inlet and atmosphere. The flow meter employs the same orifice plate which is part of the Bryan Donkin governor. The disturbance to stream line flow caused by the governor is minimised by a grid installed between pipe flanges well upstream of the orifice plate.

under arduous working conditions, proper care must be given by competent technicians who have some knowledge and experience of this class of plant. Unless reasonable interest is taken by those in authority, the original purpose of the installation is likely to be lost. An incorrect reading is, if anything, worse than none. Failure is not always due to the instrument itself but can be connecting pipe chokeage, ingress of dirt or various local conditions of plant.

It is of particular value to an undertaking to employ an individual whose responsibility and interest will be solely concerned with the instruments and similar equipment. Where a considerable amount has been supplied by one manufacturer, arrangements should be made for a short period of training at the factory. In this way the undertaking's instrument engineer can acquire a better working knowledge of his installation and become capable of making small adjustments and calibration checks.

DISCUSSION

The **President** (Mr. P. J. Wride), Tredegar, was in the chair, and before the presentation of the paper, **Mr. J. F. Rust**, General Manager and Engineer of the Newport undertaking, extended a warm welcome to the members.

Mr. F. Dawson (Barry) asked whether the author could express any view as to the most suitable type of meter to use for checking the volume of gas going out on a district comprising 700 houses, all domestic. He had obtained zero

(Continued on p. 730)

BRIQUETTING AS A SOLUTION TO THE BREEZE PROBLEM

By D. J. MAUNDER, Assoc.M.Inst.Gas E., Torquay

***EDITOR'S NOTE:*— The author maintains that briquetting offers a practical and satisfactory method of converting coke breeze into a useful revenue-earning fuel and is a process which may well become an integral part of gasworks practice. He contends, too, that a plant of the type he describes could be used to advantage by a group of undertakings such as constitute a sub-division of an area board.**

THE problem of breeze disposal is with few exceptions a difficulty which at one time or another has forced its attention on every gas engineer. The present day obligation of supplying cleaner coke for sale, and the tendency to fuel water gas plants, producers, and boilers with dedusted coke tends to aggravate this problem. Efforts have been made to use the natural breeze in special furnaces, such as the breeze producer and the breeze burning boiler grate. The success of these methods is rather limited and as this field has been explored over a considerable period it would appear doubtful that an entirely satisfactory solution is forthcoming along this approach. Endeavours to recarbonise breeze with coal have also given on the whole disappointing results.

On the other hand the up-grading of breeze by briquetting forms a fuel which can reasonably compete with other orthodox forms in standard appliances, an important advantage in both industrial and domestic fields and which enables as such the whole of the breeze fraction of $\frac{5}{16}$ in. down to the finer particles satisfactorily to be burned. It is questionable whether this is the case when breeze in any other form is burnt in any appliance. A practical illustration of how well briquetting handles the fine material is that all dust collected by the dust extraction and vacuum cleaning plants, &c., at Torquay, is regularly added to the breeze and successfully briquetted. The amount of this fine dust represents only about 2% of the total.

In passing it is of interest to note that the breeze for disposal at Torquay amounts to under 5% of the coal carbonised and at times the whole of this production is briquetted.

During 1943 the problem of breeze for disposal was actively tackled from the briquetting angle and in June, 1946, a mobile continuously operating plant was put into operation at the Hollacombe works. This plant is truly mobile, being built entirely on a welded frame pneumatic tyred trailer. An electric supply of 440 volts D.C. and a water connection are the only external supplies required for the working of this unit.

Description of Plant

The plant in which the complete process of briquetting is carried out consists of a mill and briquetting plant proper. The mill is of the revolving wheel type having a pan of 4 ft. 6 in. diameter and is driven by a 5 H.P. electric motor. Its function is to reduce the breeze and lump pitch to minus $\frac{3}{16}$ in. and mix the two materials intimately. The breeze is measured and added to the mill by a counterbalanced hopper attached to its side and although this is a volumetric measurement, the accuracy has proved sufficient for practical purposes. A constant binder content is ensured by weighing the pitch for each batch of this intermittent process.

The briquetting section of the plant is powered by one 10 H.P. motor, the various units being operated through gear box and chain drives. The total power required to operate both units is approximately 4.1 kWh per ton of briquettes produced. An A.C. supply for the mixture feeder can be obtained from a small motor alternator mounted on the trailer but is normally taken direct from the mains.

The ground mixture is fed from the mill into a receiving hopper at one end of the trailer, the hopper being provided with a wire mesh screen to throw off any oversize material. An electro-mechanical vibrating feeder forms the base of this hopper and delivers the mixture into the boot of an elevator. In passing along the feeder tray the mixture is brought under the influence of a powerful magnet suspended immediately above, which retains any iron liable to damage the moulds if allowed to pass forward to them. The elevator delivers the mixture into the top of the fluxer and is of the chain and bucket type having a 6 in. bucket and running at a constant speed of 120 ft. per minute. The rate of mixture delivery to the fluxer is regulated by two methods. A rheostat control is fitted to the feeder circuit and by varying the setting the delivery rate may be increased or decreased at will. This control is used principally to deal with any variation caused by change of moisture content of the breeze. The other control is a limit switch which stops the feeder altogether when a predetermined level is reached in the fluxer.

The fluxer or 'pug,' as it is known in the coal briquetting industry, consists of a vertical cylindrical vessel 1 ft. 6 in. diameter by 4 ft. 6 in. deep, lined with renewable vitreous enamelled liners and lagged externally. It has two doors, one situated at the side for cleaning and maintenance purposes and the other, much smaller, at the bottom through which the fluxed mixture is discharged by an extruder paddle. Rotating vertically in the axis of the fluxer is a shaft from which radiate at various levels agitator arms and at the extreme base the extruder footpiece. The arms and extruder all extend to within $\frac{1}{4}$ in. of the enamel liners, their dual purpose being to cause the mixture to flow through the fluxer and by agitation allow the admitted steam to process the mixture evenly. The limit switch mentioned previously is situated at the top of this vessel and takes the form of a float actuating a mercury switch. Normally the float is a $\frac{1}{4}$ in. above the rotating top arm, but when the fluxer fills to just above this level a wave like motion is set up which raises the float to break the circuit. The circuit is remade only when the level falls and the float regains its original position.

Superheated steam is admitted to the fluxer through four jets situated spiral fashion in the perimeter wall, each level having its own control valve, so that distribution of the heat input may be varied at will. The normal admission pressure is about 50 lb./sq. in. at 330°C., this giving a heat input of approximately 2 therms per ton of briquettes. The mixture during its 4 mins. passage through the fluxer under the combined influence of mechanical agitation and heating is converted into a stiff semi-plastic material with a temperature of 90°C. The discharge door of the fluxer provides the most effective control point of the process, in that it governs the time the mixture is in the fluxer and the rate it is fed to the press rolls, both important factors. The cooling pan is a shallow cylindrical vessel also lined with vitreous enamelled plates and in which revolve two paddles.

Its purpose is to cool the mixture to a temperature of about 70°C., where it becomes tacky and setting is about to commence. This temperature is fairly critical, for, should it rise, appreciable sticking troubles are likely to be experienced in the moulds, while a pre-mould set takes place with subsequent structural weakness if it falls much below the figure given. The action of the paddles ensures even cooling, liberation of steam, and a steady flow of the 'tacky' mixture to a small hopper superimposed on the press rolls. A control door is situated in the base of the pan and immediately above the rolls, and is used principally for starting up and shutting down.

* From a paper presented to the Western Junior Gas Association, December 7, 1949.

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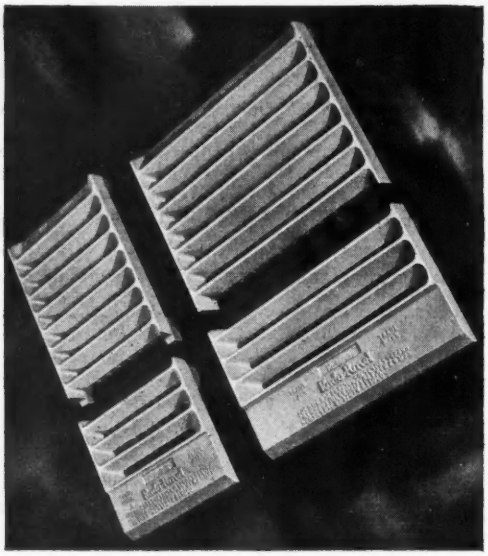

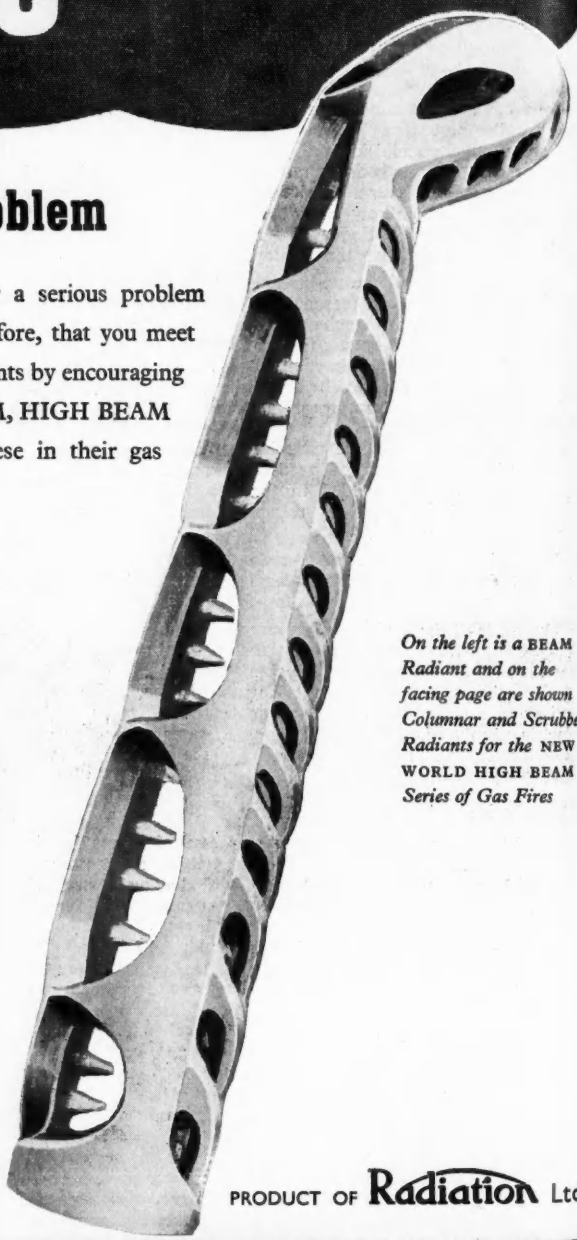

On the left is a BEAM *Radiant and on the facing page are shown Columnar and Scrubber Radiants for the* NEW WORLD HIGH BEAM *Series of Gas Fires*

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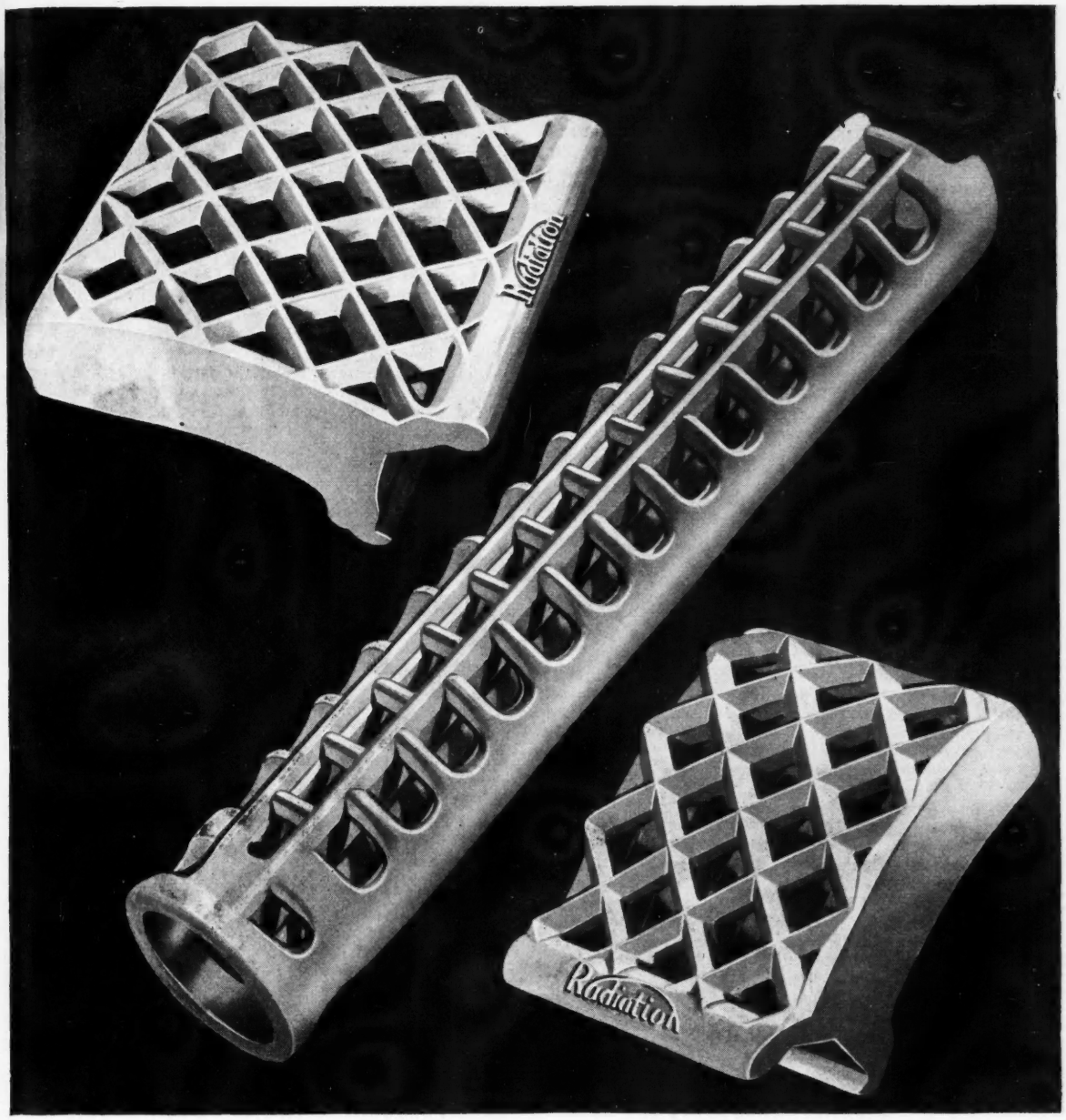

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NEW WORLD NEW WORLD NEW WORLD

The press rolls comprise two C.I. drums 20 in. in diameter and 6½ in. effective width on which are attached segmental moulds to form the shaping surface. These drums have projecting from their cylindrical surfaces short pegs which fit into corresponding recesses in the backs of the segmental moulds. This location ensures that the whole press roll is rigid and prevents any possible movement of the moulds on the drums. Two springs, one at either side, clip the specially hardened and accurately machined mould sections in position, and as the shape of their backs is the exact reciprocal of the drum periphery the only duty of the springs is to hold them in place when in an inverted position. The apparent light spring duty is confirmed in practice, the replacement of springs being rare. The moulds have three cavities abreast and the peripheral surface of each roll is made up with 30 sections; thus 90 briquettes are produced per revolution or approximately per 17 sec. A feature of this mould design is the ease of replacement, as segments can be added simply by clipping in position. The roll bearings are housed in C.I. plumber blocks, one of which is fixed while the other is free to move, and which are so mounted in a sliding framework as to give a diverging movement of up to ½ in. This movement is possible by further compression of the square helix springs which normally tension the rolls together. The two rolls do not actually come in contact, there being a distance piece interposed on either side between the bearing blocks. This just keeps the mould surfaces from touching. The tensioning is desirable not only for working flexibility but also as it provides a fair protection against damage to the moulds by the passage of foreign material through them.

Moulding Pressure

The normal moulding pressure used with breeze produced from Yorkshire coal is about three tons or approximately ½ ton sq. in. The moulding pressure to be applied is dependent on the strength of the breeze being briquetted, in that the pressure should be as great as possible, to give a dense briquette, consistent with the breeze particles not being broken down.

The fluxed material in passing through the press rolls is formed into briquettes, which fall from between the diverging moulds on to an inclined belt-elevator immediately below. It has been found that should the mixture level in the hopper feeding the rolls be allowed to build up too high, the briquettes are not neatly cut out but have a thick connecting web. This practice, if allowed, increases the fines percentage considerably. Normally the figure is under 3% of the clean briquettes. The belt-elevator is 9 in. wide with angle iron ribs and runs at a speed of 20 ft. per min. Its duty is to elevate the briquettes to the static bar screen and at the same time facilitate further cooling to a temperature of about 50°C. when the briquettes have fair cohesive strength.

From the bar screen the briquettes slide down either of the twin loading shutes into bags or barrows to be wheeled to the stock yard. It has been found an advantage to store the briquettes for a couple of days as this allows the moisture content to fall from the 20%, when first made, to a figure of approximately 5%. During this time the strength improves slightly, apparently as the moisture content falls.

General Working Details

The plant since its installation in 1946 has produced a total of just over 2,500 tons of briquettes and has solved the breeze disposal problem not by entirely eliminating the breeze market, but rather by stimulating it in maintaining only a strictly limited supply.

It is admitted that this plant does suffer from certain defects, for the most part due to the inevitable shortcomings of any prototype. The chief defect is the rather heavy labour charges, particularly in view of the one ton per hour output. Three operators are required to carry out all the operations, from charging of the mill to the stoking of the steam boiler. However, by incorporating more complete mechanical handling and using an external steam supply, the labour cost should be substantially reduced. This plant was originally designed with a variable output of 1, 2, or 3 tons per hour, but it was found that the time allowed in the fluxer for the higher rates was insufficient for correct processing and that the boiler could not produce the necessary steam.

The pan mill also has certain fundamental limitations, one of which is to increase the already large proportion of fines in the mixture. This is an evil which adversely affects the briquette strength by upsetting the grading of the aggregate, the combustion characteristics, and in addition necessitates the use of a greater pitch content. The wear of the mill elements has been heavy, new rolls and C.I. lining plates being required after handling about 800 tons. A good idea of the abrasive nature of breeze is obtained by comparing this tonnage with that obtained when mixing mortar, which is in the region of 2,000 tons.

A distinct improvement could be effected by utilising a continuous type mill which would simply deal with the $+\frac{3}{16}$ in. breeze screenings. When reduced these fines would join the remainder there to be mixed with the correct proportion of pitch previously finely divided in a separate mill.

The use of vitreous enamel coated plates for both the fluxer and cooling pan liners has been a great success, the enamel surface being ideal in that it reduces the sticking tendency around the walls to a minimum and also the abrasive wear to a negligible figure. In fact the original liners are still in the Torquay plant, although most of the enamel has now worn away and replacements are contemplated.

Novel Feature

The most novel and advanced feature of the plant is the composite construction of the press rolls, developed by the late Mr. F. F. Tapping. This type of construction is a great step forward from the former one piece press roll and has largely overcome the depreciation problem of excessive wear on the moulding elements, particularly rapid when handling breeze. Because of the small unit size employed in this form of roll construction the moulds can be produced in extremely hard alloys, conveniently heat-treated and precision finished. An equally important advantage is the short time, about one hour, required completely to renew the moulding surface, and the fact that the plant does not in any way have to be dismantled. Each set of moulds has briquetted well over 900 tons before the briquette finish deteriorated seriously.

The original moulds, instead of having their backs machined in the form of an arc, were flat, which caused them to have a rocking motion as the moulding pressure was applied and removed. This movement encouraged fine dust to work its way between the roll and moulds, which in time built up to make them stand off by as much as ⅛ in. This rocking action also caused spring fatigue with subsequent frequent replacements. The new type mould has completely overcome this fault. On the rare occasions when an individual mould does fracture, the plant has only to be stood with the fluxer door shut for a couple of minutes while the defective section is renewed by the operator.

Two shapes of moulds have so far been tried. These are the 'pillow' and, more recently, the 'pear' shaped moulds. The 'pillow' mould was withdrawn in favour of the latter as this design is capable of producing a stronger and better finished briquette. The use of vitreous enamelled moulds in place of the standard type, though not actually tried, would seem to offer advantages, and it is intended to experiment along these lines.

Raw Material and Briquette Analysis

Below are given representative analyses of the various materials used and the final briquettes produced.

Breeze.

The breeze used is that obtained from mainly Yorkshire coal, carbonised in steamed vertical retorts, and screened through $\frac{5}{16}$ in. round holes. It has the following screen analysis.

Size.	%
on $\frac{3}{16}$ in.	7.4
Thro. $\frac{3}{16}$ in. on $\frac{1}{8}$ in.	12.1
Thro. $\frac{1}{8}$ in. on $\frac{1}{16}$ in.	23.3
Thro. $\frac{1}{16}$ in. on $\frac{1}{32}$ in.	21.6
Thro. $\frac{1}{32}$ in.	35.6

The moisture content varies between the limits of 10 and 20%, but averages approximately 16. In favourable weather this figure may be reduced by 2 or 3% in storage at the plant. It should be noted that a low moisture content is desirable for briquetting.

Proximate Analysis.

Moisture	17.0%
Volatile matter	1.5%
Fixed carbon	71.0%
Ash	10.5%

Vacuum Cleaning Dust.

This dust is finely divided and about 90% passes through a $\frac{1}{32}$ in. screen.

Moisture	1.3%
Volatile matter	3.2%
Fixed carbon	85.8%
Ash	9.7%
C.V.	12,700 B.Th.U./lb.

The quantity represents only a small proportion of the breeze briquetted.

Pitch with a softening point of between 60°C. and 75°C. K. and S. has successfully been used. A typical present day analysis is given below.

Specific gravity	1.250
Soften point.	
Ring and ball	76.0°C.
Kraemer & Sarnow	68.0°C.
Volatile matter	63.0%
Insoluble matter	20.0%
Ash	0.2%
Sulphur	0.4%
Calorific value	16,000 B.Th.U./lb.

Atomising temperature (kinematic viscosity of 0.25 stokes) 400°F.

The proportion of pitch used is approximately 11 to 12%. This figure has been varied in experiment from about 8.0% when the briquettes have poor strength, up to approximately 18.0% when the mixture becomes unworkable in the fluxer. There is, of course, every disadvantage in using more pitch than is absolutely necessary to ensure reasonable strength.

The external appearance of the briquettes is smooth and with a dull shine, and is influenced by the degree of grinding and percentage pitch used.

Proximate Analysis.

Moisture	3.0%
Volatile matter	8.6%
Fixed carbon	79.2%
Ash	9.2%
Sulphur	1.3%
C.V.	12,850 B.Th.U./lb.
Bulk density	40 lb./cu.ft.

The production cost is made up as follows, and is based on a daily output of 6½ to 7 tons. It is influenced a great deal by the value attached to the breeze, the labour charges and the maintenance costs.

	Amount per ton.	Cost shillings.
Raw Materials.		
Breeze at 10s. 6½d. per ton delivered	88%	9.3
Pitch at 119s. per ton delivered	12%	14.3
Operating Power.		
Electricity at 2.5d. per unit	4.1 kWh	0.9
Boiler fuel at 55s. per ton	0.49 cwt.	1.4
Operating Labour.		
Three operators at 2s. 1.8d. per hour	24 man hours per day	7.6
Maintenance		5.2
Depreciation, at 10% on £3,200		3.3
Interest at 3%		1.0
Cost per ton (shillings)		43.0

The market figure of briquettes at present ruling is 55s. per ton ex-works.

Utilisation

From consideration of the briquette analysis and other data it is apparent that in comparison with coke fuel more ash will be formed, also the low volatile content in conjunction with high density will give poor ignition qualities and necessitate good draught conditions. These observations are all realised in practice. The extra ash is not serious, but it is a household deterrent to the use of briquettes. The ignition qualities are also disappointing and it is desirable to start off a domestic briquette fire with a layer of wood or the like. However, once the briquette fire has got under way the radiant heat output is above that given by a corresponding size of coke fire. It should be noted that when allowance is made for their high bulk density the output is approximately the same. This result clearly shows that the briquette fire is of a high standard. It has been found that if briquettes are coked prior to used the ignition qualities are greatly improved and compare very favourably with those of coke.

Following casual observation of the mechanical failure of briquettes on initial firing, investigation was made of the cohesive strength during all their burning life. The results obtained showed that immediately upon firing the strength dropped sharply to near zero only to regain almost immediately approximately the original strength. The period during which the strength is negligible is dependent on the prevailing temperature, which also influences the rate of strength decline and recovery. In cases where the coking action took place slowly the final strength rose above the pre-fired briquette.

Appreciation of these facts make it quite clear that no disturbance of the fire, however small, is desirable until the coking action is complete. To obtain the best results the fire must at all times be maintained bright and fired 'little and often.' This ensures swift completion of the coking action and also very near complete combustion of the smoke-forming constituents. In industrial practice unless this point is carefully watched a smoke nuisance of some magnitude may be created. The same general technique should be followed with domestic fires.

A further good quality obtained with briquette fuel in both domestic and industrial practice, providing the firing operations are correctly carried out, is that not only do the briquettes coke individually, but also one to another and so form a crust. This action if encouraged in successive tiers tends to give an open fire capable of lively combustion.

Briquettes have been used with success on Lancashire, Cochran, and Economic boilers, as well as in domestic grates. Consideration of the characteristics of briquettes would suggest their use on mechanical grates or with coking type stokers as ideal.

General

Briquetting offers a practical and satisfactory method of converting breeze, a very near waste product, into a useful and revenue earning fuel, and is a process which may well become an integral part of the gas industry.

Its attractions are likely to increase as the technique is developed and improved and even more so if the present tendency of increases in the cost of basic fuels continues. In addition it is fairly certain that in the future increasing amounts of breeze will be for disposal. This will be due partly to the expansion of the industry but more as a natural result of the present-day policy of supplying cleaner and more closely graded coke fuel for sale, the standards of which must inevitably become more stringent. A further factor is the advances made in gas-making plant which require cleaner operating fuels, partly to reduce depreciation of the equipment and in an endeavour to obtain even higher efficiencies.

Other developments in works practice liable to affect this problem are the increasing use of low pressure exhaust steam for process work and the steaming of producers, retorts, and

. . . and

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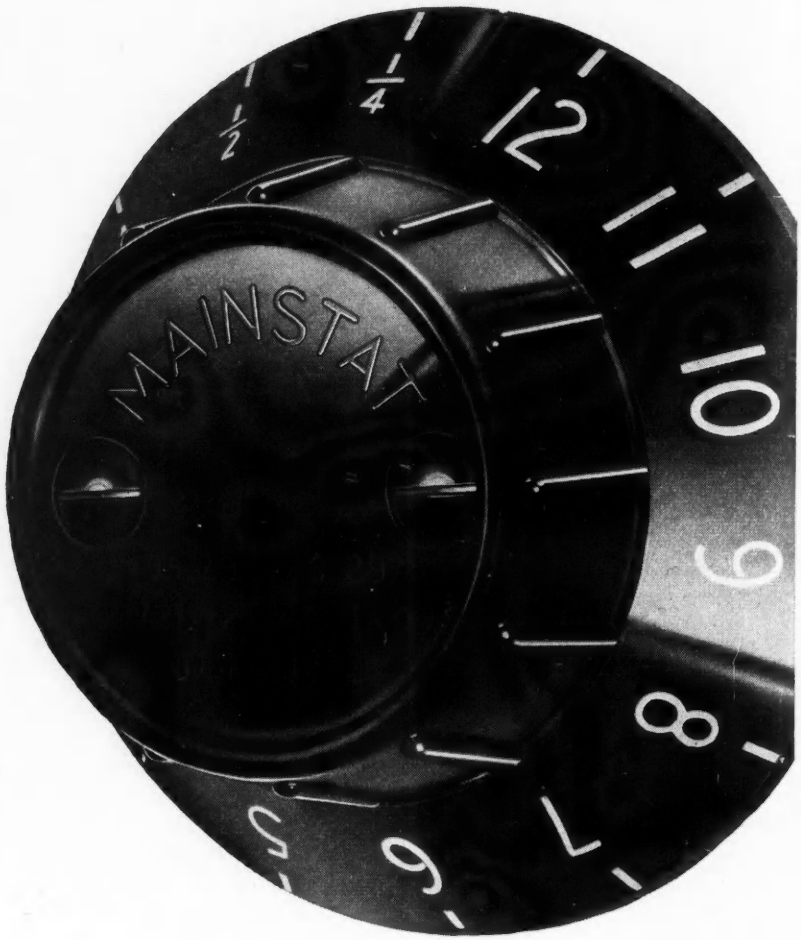

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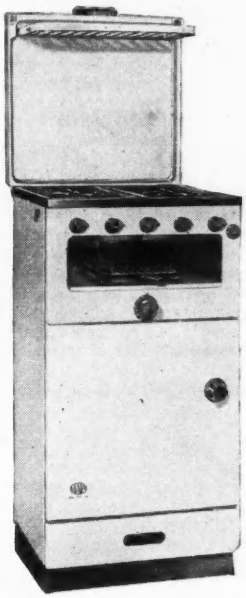
Platerack and backplate, or short splashplate . . . Hinged cover with shelf . . . Oven heights: 14" or 16". (Portal, 14" only) . . . Hotplates with 3 or 4 boiling burners and a high-speed grill . . . Cast iron legs, plinth base or tubular legs . . . finishes are in dapple/white, or cream black.

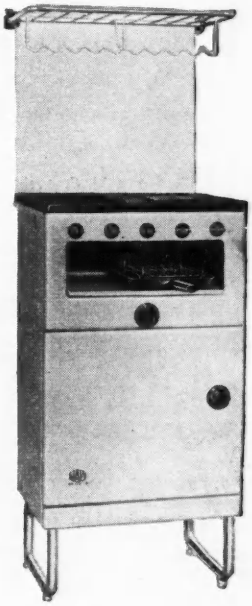
177 with short splashplate; 3 boiling burner hotplate; 16" oven; cast iron legs; dapple/white finish.



177 with hinged cover and shelf; 4 boiling burner; hotplate; 16" oven; plinth base; cream/black finish.

177 with short splashplate; 3 boiling burner hotplate; 14" oven; plinth base; dapple/white finish.

177 with platerack and backplate; 3 boiling burner hotplate; 14" oven; tubular legs cream finish.



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the like, the operation of works plant by power from the grid, and the development of plant largely self-sufficient in steam. All or any of these tendencies will inevitably increase the breeze for disposal.

For example, in the latter cases the effect will be to lessen considerably the overall steam requirements which in turn will reduce the solid boiler generated steam to a comparatively insignificant amount, and thus even if breeze is used to generate this steam, the amount required will bear no relation to that available.

A plant of the type described could be used to advantage by a group of undertakings such as form a present subdivision, particularly when it is composed of small to medium sized works spread over a considerable area.

A technical advancement which should be explored is that of coking the briquette so as to give a smokeless and constant strength fuel. This would allow of their use, at present ruled out, on account of the powdering tendency when first fired, in processes where rigidity is an important factor. This practice would open up the possibility of using briquettes internally in the industry on gas-making plant, which in turn would permit greater quantities of clean graded coke to be sold per ton of coal carbonised.

In conclusion I thank my chief, Mr. J. W. Denton, for the facilities he has placed at my disposal. I should also like to record my thanks to Messrs. Robert Cort, the makers of the plant and to members of the Torquay staff for their generous help.

INSTRUMENTATION AND GRID CONTROL—Continued from page 722

readings when as a matter of fact a certain quantity of gas was being used for lighting.

Mr. **James** replied that it was immaterial whether the load was all domestic or not. Where the flow was extremely low —less than 10% of the average (not peak load) figure the answer was that a differential meter should not be used because the reading obtained would not be accurate on so small a flow.

Mr. **H. Buckley** (Pontypool) enquired at what pressure it was usual to operate the high pressure long distance measurement transmitter described in the paper. He also asked whether Mr. James's Company operated any scheme whereby gas undertakings could send young men to them for training in the use and maintenance of instruments. None of the smaller undertakings—and not even one of the size of Pontypool—would be justified in having an instrument specialist of its own, but it would probably pay the area boards to have on their staffs a specialist in such instruments who could look after the installation of several works. On the question of the remote indication of gasholder stocks he recalled that on a waterworks—where the undertaking seemed to have been more instrument-minded than the average gas undertaking—a cotton reel type of gramophone record was used whereby, in response to a telephone call, the man at the central control office was promptly informed that the depth of the water in the reservoir was so many feet and inches at any given moment. He wondered whether the principle could be applied to gasholders.

Mr. **James** said that the ring balance type of transmitter took care of pressures up to 30 lb. per sq. in. The high pressure meter type started at about 1 lb. and could operate at several hundred of pounds per sq. in. There were high pressure systems working from 5 lb. to 30 lb. per sq. in.; in practice they seldom had to go as low as 1 lb. per sq. in. With regard to training he thought he was speaking for instrument manufacturing firms generally when he said that training facilities were usually available. His own Company had a definite procedure for the training of clients' technicians. They took men from the various industries they served and operated a route card system. For example, a technician coming from the gas industry for a course of two weeks (the minimum period) or preferably a month would receive cards to route him through the departments in which he would be mostly interested. If he came from the manufacturing side he would go to the CO_2 meter and similar departments, whereas if he came from the distribution side he would pay more attention to pressure recorders and the like. Clients were always welcome to visit the works. It was always advantageous to have first hand knowledge: equipment was usually better serviced as a result, and in the long run the manufacturer enhanced his reputation. It paid the instrument manufacturers—who were not always philanthropists—to take considerable trouble in training clients' technicians, and his own Company undertook to find accommodation for them, financial responsibility being left to the undertakings concerned, and at the end of the course the technician took away with him the necessary instruction books, drawings, &c., for use in his practical work.

With regard to the gasholder stock transmitter, very few if any more than one gramophone records of the cotton reel type had been made. The mechanism involved was very delicate and expensive, and could not be mass-produced.

Mr. **W. H. Evans** (Cardiff) raised a question as to the advantages and disadvantages of using G.P.O. lines and enquired what precautions it was possible to take to protect delicate instruments from condensation and dirt.

Mr. **James** replied that it had been his Company's experience that complaints reported by undertakings utilising G.P.O. lines had been negligible. The G.P.O. had an elaborate system of maintenance and gas undertakings hiring their lines had a priority which ensured remarkably good service. It was amazing how quickly the G.P.O. engineers discovered a fault and put it right. While in some instances it might pay to put in private lines it had to be remembered in comparing costs that the G.P.O. rentals included a charge for maintenance, an item which might become substantial if it had to be carried out at the undertaking's expense.

No instrument had yet been made which was entirely dust-tight. Dust got into instruments wherever they were housed, and especially in a retort house. As soon as one opened an instrument to change a chart a certain amount of dust was admitted. Possible alternative remedies were to put the instruments into a special brick-built room and pressurise the room in order to maintain sufficient pressure to keep the dirt out; or to pressurise the instrument panel itself.

Mr. **J. V. Drake** (British Benzole and Coal Distillation, Ltd., Bedwas), speaking from the point of view of an undertaking concerned with the measurement of crude gas, said that on a reasonable sized works it was not economical to have a man dealing exclusively with instruments, but in the laboratory there was usually at least one young man with a flair for instruments who might, with help from the manufacturing firms, undertake the responsibility of looking after the instruments. It was important to remember that where there was complete instrumentation the full co-operation of the operatives must be enlisted. Unless the operatives were instrument-minded the best of systems was liable to failure. He suggested that a good policy, especially for the larger works, was to arrange periodical talks to groups of men on the working and purpose of instruments in order to convince them that they were there to promote efficiency, and that it was their duty, when officials were not about, to look after the instruments and see that they were kept in order.

Mr. **James** heartily agreed with Mr. Drake on the question of maintaining the interest and support of the man actually on the works. The metering of crude gas raised difficult problems, and he felt the manufacturers of instruments were right in turning down any proposal which they felt was too risky. He had, in fact, declined to accept orders himself rather than undertake to install instruments which were not likely to give satisfaction.

Mr. **S. G. Meade** (Newport), Hon. Secretary, proposed, and Mr. **H. Buckley** (Pontypool) seconded, a vote of thanks to Mr. **James** for his paper. Mr. **James** briefly replied, and mentioned that copies of the full paper which he gave to the London and Southern Junior Gas Association in May, 1948 (published in booklet form), are available from Electroflo Meters, Co., Ltd., Park Royal, London, N.W.10.

At the close of the meeting the members were entertained to tea at Lovells Café as the guests of the Newport undertaking. Thanks for this hospitality were expressed by Mr. **R. J. K. Shepherd** (Neath) and Mr. **T. E. Tyrrell** (Port Talbot), and suitably acknowledged by Mr. **Rust.**